

THE FEEDING HABITS OF MÆRITHERIUM AND PALÆOMASTODON.

THROUGH the discoveries in the Oligocene¹ of the Fayûm Mæritherium and Palæomastodon have become famous as two of the earliest, and more or less direct, stages in the ancestry of the elephants. In restorations by various authors each of these animals has been provided with a proboscis of less or greater length, as would befit a more or less remote ancestor of an elephant. As first announced by Dr. C. W. Andrews, to whom we are chiefly indebted for our present knowledge, Mæritherium does anticipate the Palæomastodon type in the enlargement of the second pair of upper and lower incisors and in the general pattern of the grinding teeth. Since the wish is always father to the thought, and nothing is more to be desired than a primitive progenitor of the Proboscidea, it was altogether natural to place Mæritherium in or near the line of ancestry of the elephant, and in such ancestry, as a member of the Proboscidea, the animal has gone into general literature.

A first more cautious note was sounded by Dr. Andrews in his memoir of 1906,² p. xvii, in which he observes:—"As already mentioned, Mæritherium was probably an amphibious, shore, or swamp living animal, and it was no doubt owing to the continuation of the conditions favourable to its mode of life that it persisted into the Upper Eocene period. In the meantime, however, either from this or some closely allied type, there had arisen another animal more adapted to terrestrial life and showing a great advance in the direction of the typical Proboscidea: to this creature the name Palæomastodon has been given." Elsewhere (p. xxi) Dr. Andrews notes that Mæritherium favours the view, first put forward by de Blainville, of an original relationship between the Proboscidea and Sirenia. Later on in the same work (p. 119) the same author, in commenting on the similarity between the pelvis of Mæritherium and that of the Eocene sirenian Eotherium, observes:—"Then it may fairly be suggested that Mæritherium and Eotherium, both occurring in the same region (one the most primitive Proboscidean, the other occupying the same position with regard to the Sirenia), are, in fact, closely related, and had a common ancestor in early Tertiary times, probably in the Lower Eocene." On p. 105 we find a comment on the remarkable likeness between the brains of Mæritherium and the Sirenia.

Since these suggestive comments were written other materials have been secured, including a nearly perfect skull and jaws of Palæomastodon by the British Museum and a skull of Palæomastodon and two partly preserved skulls of Mæritherium by the American Museum.

The question of habits and of affinity seems so important and interesting that the writer has taken it up afresh with these additional materials. The inquiry was suggested by the general resemblance which the skull of Mæritherium bears to that of a Sirenian as seen from above and in palatal view. The method of comparison adopted is that of making life-size models of the skulls of Mæritherium and Palæomastodon, then placing the sense organs and the mouth parts in position, guided solely by comparison with existing mammals showing more or less analogous modifications and by the actual condition of the hard parts themselves. This work was done by Mr. E. Christ-

man under the writer's direction.¹ Palæomastodon itself in all probability had not developed a proboscis, although there is no question as to its being in the direct line of proboscidean ancestry. Mæritherium not only had no proboscis, but was totally different from Palæomastodon both in its appearance and habits, and only very remotely related to this animal, if at all. The study shows, further, that Mæritherium is closer to the Sirenians and less close to the Proboscidea than has hitherto been supposed.

A profound difference between these animals is brought out in comparing the top and side views of the skull, when it is seen that, whereas the eyes of Palæomastodon are in the typical mammalian position above the first permanent grinder, those of Mæritherium are very far forward, well raised in the front part of the head, and of very diminutive size, as shown by the shallowness of the sockets. All these are also characters of the Sirenian head. As indicated by the auditory meatus, the ears are relatively in a more elevated position than in Palæomastodon. Both these peculiarities are adaptations to aquatic life to protect the sense organs and bring them near the surface of the water in swimming, so that they will emerge first and disappear last.

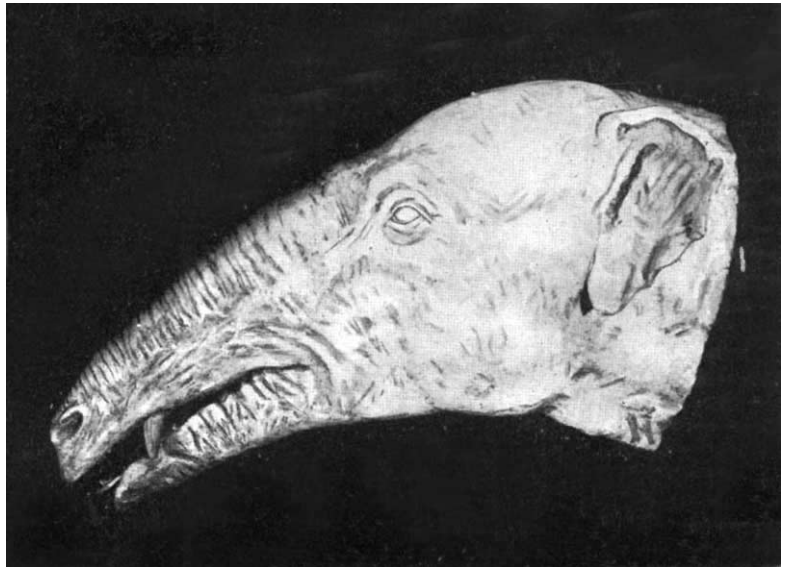


FIG. 1.—Side view of the head of Palæomastodon modelled by Mr. E. Christman under direction of the author.

The cutting teeth and mouth parts of Mæritherium are also opposed in an entirely different manner from those of Palæomastodon, so that it may be said safely that there was not the most remote resemblance either between the mouth parts or the feeding habits of these two animals. In the former the nasal bones do not greatly recede, and there was consequently little or no free retractile power of the upper lip, which is always the rudimentary condition in the evolution of a proboscis, as witnessed in the living tapirs. Comparison with Hyrax, the beaver, and other animals with an enlarged pair of front teeth tends to show that the upper and lower lips were heavy and fleshy, somewhat similar in form and function, that is, in prehensile power, and that the blunt tusks may have been covered when the mouth was closed, somewhat as in the hippopotami. These tusks were feeding rather than fighting weapons, probably because Mæritherium was protected from attack by its aquatic habitat. The conclusion is that Mæritherium was a confirmed and continual river-living animal, feeding mainly under water and on the banks, more specialised for aquatic life than the hippo-

¹ These Palæomastodon beds were at first regarded as Upper Eocene, but closer comparison with those of Europe has shown that they should be rather considered as Lower Oligocene.

² "A Descriptive Catalogue of the Tertiary Vertebrata of the Fayûm, Egypt." (London, 1906.)

¹ The models have been reproduced and copies presented to the British Museum. The writer is indebted to Mr. W. K. Gregory for many valuable suggestions.

potami, as indicated by its feeble pelvis, but less specialised than the Sirenians. It would not be far from the truth to say, from our present knowledge of the animal, that *Mœritherium* is an offshoot of the Proboscideo-Sirenian stock, with *slightly* nearer kinship to the elephants than to the Sirenians.

The distinctive peculiarities of *Palæomastodon* are that its eyes are in the position typical among mammals, that is, above the first true grinders. The reason that they appear to be so far back is that the lower jaw is extended unusually far forward. The upper jaws, on the other hand, recede, practically terminating at the sides in the very sharp, laterally compressed tusks, which at this stage were chiefly developed as fighting or defensive weapons, while only indirectly of value as feeding organs. It is noteworthy that when the upper and lower lips are restored in such a manner as to enable the animal to close the mouth, the upper tusks are so largely covered that they are not especially prominent.

In contrast with *Mœritherium*, the nasal bones and openings deeply recede; thus a very wide space is left to be filled by a large retractile upper lip, which could undoubtedly be raised or lowered. The question now

power of the anterior portion of the lower jaws, these parts having receded and disappeared. The elephant thus presents the widest possible contrast with *Palæomastodon*, in which the most prominent part of the face is the projecting lower teeth and jaw. It is obvious that the development of a proboscis took place step by step with the recession and loss of prehensile power in the lower jaw. If *Palæomastodon* had possessed an independent prehensile proboscis extending beyond the line of the mouth for the seizing of food, we cannot assign any function to these large and much worn lower incisors. A more probable view, therefore, seems to be that here presented in the model of the head and mouth parts, which were made directly upon a model of the skull itself. In the stages between *Palæomastodon* and the *M. (Trilophodon) angustidens*, the Lower Miocene elephant of Europe, the lower incisors have begun to transform into tusks to be employed in uprooting plants and smaller trees, just as the upper tusks are used by elephants now. With this change their prehensile function was gradually abandoned and assumed by the upper lip, which thus began its slow evolution into a freely projecting and prehensile proboscis.

All restorations contain a large element of conjecture; we shall certainly never know how these most interesting animals of the Lower Oligocene rivers of the Fayûm actually appeared, but the first rule of restoration is not to be too much influenced by kinship, but to adhere to the evidence afforded by the hard parts themselves. This rule has evidently been broken by the writer in attributing a small elephantoid ear to *Palæomastodon*. Unfortunately, there is no means of even conjecturing the shape of the ear of this animal, except to exclude the small aquatic type of ear which may be attributed to *Mœritherium*.

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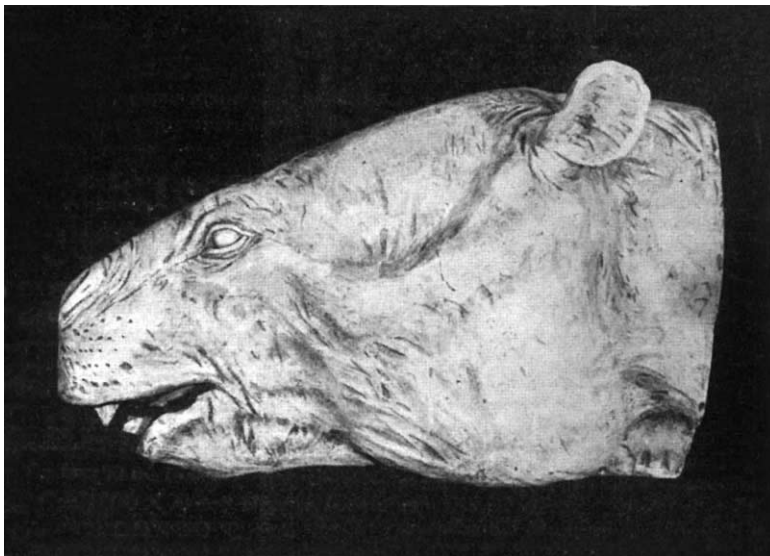


FIG. 2.—Side view of the head of *Mœritherium* with the eye and ear in position. The form and position of the nostrils is somewhat conjectural. Modelled by Mr. E. Christman under the direction of the writer.

arises, How far had this lip begun to transform into a proboscis? Was there a free projecting proboscis as represented in several previous restorations? A negative answer appears to be furnished by the structure and mode of wear of the lower incisors. Together these form a broad, protrusive, spoon-shaped feeding organ, which is invariably greatly worn on the upper surface and somewhat less at the ends. This worn upper surface seems to prove that in the prehension of food the edge of the upper lip was constantly pressed downward against these teeth, thus, with the aid of fine particles of grit and sand, which were occasionally taken in, causing wear. In brief, the food appears to have been seized between the upper lip and the spoon-shaped lower teeth. *Palæomastodon* was a browser, and this lip could be turned up and retracted effectively to pull down smaller branches, but there is no reason to suppose that it had the free curling and independent prehensile power which characterises a true proboscis. If we critically consider the theory of the animal possessing a proboscis of considerable length, we find it rests upon the idea of kinship with the elephant rather than upon careful study of the mouth parts themselves.

If, now, we consider the elephant, we find that one of its many unique features is entire loss of the prehensile

Royal Commission on Sewage Disposal. It is difficult within the space of a few paragraphs to present a comprehensive review of the varied topics which came up for discussion in the different sections, and embraced anything from the treatment of tuberculosis to that of trade effluents, and from the ventilation of cowsheds to the hygiene of the mouth.

Although many of the views expressed, especially in the recently formed child-study section, were of a tentative nature and the result of incomplete experience or of individual opinion, a striking feature of the congress was the earnestness displayed by those participating in it, a remarkable fact when one considers how much of the work connected with sanitary matters is self-imposed, largely unofficial, and purely disinterested.

It seemed appropriate that the president, an old Leeds citizen, should have referred in his opening remarks to the sanitary improvements of the town, which had nearly halved the death-rate in fifty years; but the greater part of his address was devoted to a general survey of the growth of public interest in and control of sanitation, and the present-day problems of urban life. Among the present-day problems he referred to the continued high mortality from phthisis, pneumonia, and diphtheria, and the heavy death-rate among children. Although the presi-

THE HEALTH CONGRESS AT LEEDS.

THE Royal Sanitary Institute and the Royal Institute of Public Health combined this year, for the first time, to hold under the auspices of the Corporation and University of Leeds a joint session.

No more fitting person than Colonel T. W. Harding could have been selected to fill the presidential chair, who fills at the present moment the important office of chairman of the Royal Commission on Sewage Disposal. It is difficult within the space of a few paragraphs to present a comprehensive review of the varied topics which came up for discussion in the different sections, and embraced anything from the treatment of tuberculosis to that of trade effluents, and from the ventilation of cowsheds to the hygiene of the mouth.